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CULTURAL RESOURCES SURVEYS: GENERAL GUIDELINES

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1. Introduction

These Guidelines contain detailed instructions for the implementation of United States laws and regulations relating to the protection of cultural resources on Federal and non-Federal land. Their intent is to specify standards and procedures; they are issued by the Nevada BLM and their applicability is limited to BLM (and relevant non-BLM) lands in that state. Care has been taken to ensure that they differ from U.S. laws and higher level directives (Presidential, Dept. of Interior, Washington BLM) only by the greater specificity appropriate to implementation on the state level and within the discretionary limits allowed by these laws and directives.

The BLM is required by law* to ensure that Bureau initiated or authorized actions do not inadvertently harm or destroy cultural resource values.

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*The applicable Federal laws and regulations include the following:
Antiquities Act of 1906 (P.L. 59-209)
National Historic Preservation Act of 1966 (P.L. 89-665 as amended (P.L. 94-422 and P.L. 94-458)
National Environmental Policy Act of 1969 (P.L. 91-190)
Archeological & Historic Preservation Act of 1974 (P.L. 93-291)
Federal Land Policy & Management Act of 1976 (P.L. 94-579)
American Indian Religious Freedom Act of 1978 (P.L. 95-341)
Archeological Resources Protection Act of 1979 (P.L. 96-95)
Executive Order 11953
BLM Manual 8111

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Because most cultural resources are unidentified, irreplacable, localized and highly sensitive to ground disturbance, it is necessary that they be properly identified, evaluated and fully reported prior to any proposed impacting action. Appropriate procedures for meeting these requirements are given in the succeeding pages. If, as a result of the implementation of these procedures, cultural values are determined to be absent, or if adequate protective measures can be devised, the proposed action may proceed. If, on the contrary, adequate measures cannot be devised, or are prohibitively expensive, the proposed action cannot proceed without further consideration.

The following pages are intended to provide comprehensive guidelines for cultural clearance work on BLM administered land in Nevada. They are accordingly addressed both to the organization or BLM program proposing impacts on public lands ("operator") and the field archeologist—whether BLM or non-BLM—responsible for the on-the-ground inventory. For the same reason, they discuss not only the general standards and procedures applicable to BLM and non-BLM personnel and organizations alike, but also the specific requirements appropriate to each party: operators, BLM archeologists, and contract and other non-BLM archeologists. It is expected that all these parties will be thoroughly familiar with the contents of the guidelines before commencing any action and will comply with all relevant provisions.

II. General Procedures and Guidelines

1. Initial Procedures

Operators are generally required, at their own expense, to make cultural resource inventories for projects on BLM lands anticipated to include surface disturbing activities or transfer of title from Federal ownership. For projects involving both BLM and non-BLM (including private) surfaces, inventories of the non-BLM lands may be required in addition to the BLM. This also applies to non-BLM (including private) surfaces in the case of projects testing for, or exploiting, BLM administered subsurface minerals or energy resources. In many cases, the extent and intensity of non-BLM land inspection will have to be established on a case-by-case basis through consultation with the BLM District Office and the Nevada State Historic Preservation Office (SHPO) before the field survey. Care must be taken to avoid infringing the rights of the private landowner whose permission must always be obtained prior to entry on his land.

If cultural resources are found as a result of the survey, the field archeologist must formulate proposals ("recommendations") for their protection which, if accepted by the BLM District or Area Manager, must subsequently be complied with by the operator. In general, there are two options for the protection of cultural resources in these circumstances: avoidance and data recovery. The costs of data recovery, which may include detailed written description, mapping, drawing, photography, collection and/or excavation are borne by the operator.

Different policy in
BLM depending upon
who "operator" is –
BLM stands cost if
RI project or DLE, but
operator does if mineral
lease. Also, BLM does
re: new 3809 regs:

Data recovery, particularly when involving collection/excavation, can be very expensive and time consuming so that, whenever project constraints permit a choice, avoidance will almost always be to the operator's advantage. Any alternative project locations proposed as a result of avoidance recommendations must themselves be surveyed (and cleared), for cultural resources before the project can proceed.

Cultural resource field inventories cannot be conducted when snow is on the ground (see p. 4). Operators and field archeologists should bear this fact in mind when figuring lead time for field inventories, as failure to do so can result in serious delays in operation approval.

The operator shall employ the services of a competent field archeologist who holds a valid Federal Antiquities Permit. These permits are issued to qualified individuals by the U.S. Department of the Interior (see Appendix II for Antiquities Permit requirements and stipulations for the Nevada BLM).

The non-BLM field archeologist must contact the appropriate BLM District or Area Manager, or his authorized representative, before the beginning of each field operation to (1) inform him of the date and location of the impending investigation and (2) to ascertain if previous cultural resource inventories have occurred within the immediate area of the proposed project. Phone contact must be immediately followed up by written communication. The District has the option of imposing whatever project-specific stipulations, additional to those of the Antiquities Permit and these Guidelines, deemed necessary or desirable and may exercise this option either at the time of initial contact with the field archeologist or thereafter.

It is important that the field archeologist have prior knowledge of the physical characteristics and cultural resources of the general area of the project so as to be able to form an expectation of the kinds of sites, and their environmental settings, he is likely to encounter during the survey. The site files at the BLM District Offices and at the Nevada State Museum are fairly comprehensive and complete while, for many areas of the State, the persons most knowledgeable about the local cultural resources are BLM District staff personnel.

2. Field Survey Procedures

The operator is responsible for clearly marking the project area on the ground by staking, flagging or some other visible means in advance of clearance surveys. If this is not done, and doubts subsequently arise about the location of the surveyed ground, re-survey may be required before the project can proceed. For linear projects (seismic, power lines, etc.) the maximum allowable interval between non-intervisible flag stations is 1/8th mile; the interval between intervisible flag stations may be up to 1/2 mile.

Except under the circumstances subsequently noted, all cultural resource clearance surveys must meet the current Nevada BLM "Class III" standard (BLM Manual 8111.14), that is (1) they must be on foot (unless this requirement is specifically waived by the BLM District Office and SHPO prior to the beginning of field work) and (2) the maximum interval between transects cannot exceed 30 m. Additionally, clearance surveys cannot be undertaken when snow is on the ground unless coverage is less than 30% and is static or diminishing.

Normally, the only practical procedure for surveying narrow linear project areas (pipe, seismic or fence lines) is by one or two transects along the proposed route of the line. In the past "official" corridor widths (zones defined by the operator and/or field archeologist in which impacts to cultural resources are expected to be confined) have varied from project to project in an arbitrary way not reflecting any real differences either in potential damage to CRs or in acreage or survey intensity. Due to the difficulty of objectively defining these zones, this problem may be expected to continue. For this reason, it will be Nevada BLM policy to compute the acreage (and thus survey intensity) of narrow linear projects on the basis of a nominal corridor width of 30 m, whether or not this figure coincides with the "official" corridor widths of the projects concerned. It should be noted that actual field procedures will be unaffected by this policy, which is adopted here solely as a means of obtaining comparable acreage/intensity figures for similar surveys. 30 m is particularly convenient for this purpose in that minimal coverage (single linear transect) equals minimum Class III coverage and thus also allows valid comparisons with survey results for non-linear project areas. Acreage/intensity figures for broad linear projects (e.g., transmission lines with zones of impact greatly in excess of 30 m) will, of course, continue to be calculated on the basis of the "official" corridor width.

In certain cases, a lesser degree of coverage than called for by Class III standards may be acceptable for clearance purposes. For example, areas of very rough or otherwise inhospitable terrain may not be conducive to maintenance of strict interval spacing. Likewise, areas badly distrubed by recent activities which are likely to have led to the destruction or removal of archeological remains and/or to have severely reduced or destroyed the evidential value of whatever survives, may not be worth the considerable effort required to survey them to the Class III level. Finally, for certain types of very large projects, surveys based on 30 m transect spacing may be ruled out by logistical considerations: cost, time, availability of personnel, etc.

Surveys of the type described in the previous paragraph are acceptable for clearance purposes (i.e., may be substituted for Class III surveys) only if justified by a detailed rationale in the survey report (difficulties arising from the failure of the operator to allow sufficient lead time for the performance of a Class III survey will not be considered adequate justification). They may be used by non-BLM field archeologists only with the prior approval of the BLM District Office.

3. Cultural Resource Recording and Collection Policy

Site inventory forms (obtainable from the BLM District Offices) will be filled out for all cultural resource sites discovered in the course of the survey. Alternative forms acceptable to the BLM District Office may also be used.

A. Definitions & General Procedures

A cultural resource "site", in the present context, is any physical evidence of former human presence more than 50 years old. Examples can include anything from a single isolated artifact (stone flake or projectile point, glass bottle fragment, square-shanked nail) to vestiges of an old trail, historic period dump or 19th century mining operation, to a large aboriginal village or historic town site. Note that cultural material less than 50 years old is specifically excluded from consideration as a "cultural resource" under the above definition and need not be recorded on site forms. However, the presence of such phenomena as drift fences, recreational hunter camps, unofficial roads, graffiti, garbage dumps, etc., should be noted in the survey report as documentation of the recent and current human use of the area.

Sites may be encountered which extend beyond the limits of the project area. Sites of this kind must be fully recorded, including the parts outside the project boundaries. Under exceptional circumstances (e.g., when small portions of very large sites slightly intrude within project area boundaries) partial recording may be justified but can only be adopted with the approval of the SHPO and the BLM District Office prior to the completion of fieldwork. If a site is partially recorded, that fact should always be clearly stated on the site form.

B. Collection Policy

Artifact collection can entail considerable direct and indirect costs both to the operator and to the BLM and should be avoided whenever possible. In some cases, however, project constraints or other factors preclude any other course.

In general, partial or total collection is allowed under the following circumstances: (1) when site integrity is seriously threatened by project-related activities or (2) when there is a serious short-term threat of disturbance from natural processes (e.g., erosion) or from illegal collection. Guidelines for the collection of sites of different types and sizes are presented in tabular form below. Note that the collection of three of the six site categories tabulated ("small" and "large" "nondescript" sites and "small" sites "with diagnostics and/or spatial patterning") may be performed by the non-BLM field archeologist without the specific consent of the BLM and SHPO, but that the collection of the other three types requires such consent.

	Nondescript Sites	Sites w/Diagnostics &/or Spatial Patterning	Sites w/Depth Potential &/or Architectural or Other Features
Small Sites (20 or fewer artifacts)	Normally no collection (record in field). Total collection minority option (must justify in terms of regional study objectives). No excavation w/out prior consultation with BLM/SHPO.	Field recording & total collection only option. No excavation without prior consultation with BLM/SHPO.	Field recording. No collection/excavation without prior consultation with BLM/SHPO.
Large Site (21 or more artifacts)	Normally no collection (record in field). Sample/total collection minority option (must justify in terms of regional study objectives). No excavation without prior consultation with BLM/SHPO.	Field recording. No collection/excavation without prior consultation with BLM/SHPO	Field recording. No collection/excavation without prior consultation with BLM/SHPO

Definitions

Small Sites = sites with 20 or fewer portable artifacts.

Large Sites = sites with 21 or more portable artifacts.

Nondescript Sites. These comprise isolates or groups of portable artifacts, normally lithic, ceramic, glass or metal. Time markers and cultural diagnostics are lacking, often, probably, as a result of illegal collection in the past. Artifact distribution is apparently random, there being no readily discernable spatial patterning. There is no obvious evidence for a subsurface component and architectural and other features are absent.

Sites with Diagnostics &/or Spatial Patterning. These comprise sites with culturally or temporally diagnostic items and/or readily discernable spatial patterning in artifact distribution corresponding to special activity areas or discrete chronological horizons.

Sites with Subsurface Components &/or Architectural or Other Features. These comprise sites with likelihood of depth of deposit and/or with buildings, hearths or other features either coeval in date with any portable artifacts present or, if different in date, themselves old enough to merit "antiquity" status under the 50 year rule.

Regional Study Objectives. Acquisition of specimens for future physical analysis (e.g., petrological typing, ceramic temper analysis, obsidian hydration analysis, etc.). Note that collection of specimens is allowed under this policy without obligating any party (BLM, Operator, Field Archeologist) to either perform or fund the analyses concerned.

Nondescript sites are the commonest type in Nevada and, in many cases, almost certainly possess internal relationships not "readily discernable" even to the highly qualified professional observer. The technological and typological characeristics of the kinds of artifacts composing these sites can, and in the future undoubtedly will, play a significant role in cultural and chronological studies of the peoples concerned. Their "nondescript" and "undiagnostic" character is thus, in many instances, illusory, arising from the inability of the observer to recognize complex inter-relationships without detailed recording and analysis. Given current budgetary limitations, however, detailed recording of the type required to satisfactorily resolve this problem is not normally an option and, in most instances, sites will have to be classified on a "face value" basis.

The identification of sub-surface components poses similar problems to that of spatial patterning, as evidence for buried remains is seldom obtainable without excavation. As indicated in the Table, excavation is not a permissible option for the field archeologist and, even if it were, would probably be precluded in most cases by practical considerations of time and money. This being so, in the absence of exposed profiles or other direct evidence, reliance must be placed on general context or on whatever can be inferred about the depositional history of the ground on which the site lies. In the many cases where context offers no clue, the collection/recording procedures tabulated above for "surface sites" will apply and the tentative nature of the assessment should be indicated on the site form (e.g., "?surface," "?no depth," etc.).

Hard and fast lines between isolated objects and very diffuse sites, on the one hand, and between groups of discrete sites and components of single large discontinous sites, on the other, are sometimes very difficult to draw. As a result, professional judgment, combined with a thorough examination of the immediate vicinity of the find spot, will often be necessary to determine whether a given find or group of finds constitutes a "small site" eligible for collection under the "small site" policy.

The positions of all partially collected sites must be marked by steel rebars, permanently labeled with the site number. Rebar marking is not required for collected isolates or other totally collected sites.

The permanent or temporary relocation of artifacts, even for small distances, is not allowable under any circumstances, the only permissible protective measures being collection or avoidance. The same applies to the *in situ* burial of artifacts as a means of protection.

C. Site Recording

As in the past, all important gross site characteristics (overall dimensions and artifact class and density) should be recorded on the site form. Features such as hearths, buildings, cairns, roasting pits, rock art, etc., should be briefly described with, if appropriate, measurements and scale drawings. Sketch maps are required for any site with obvious spatial patterning or with associations with archeologically relevant man-made or natural features. When appropriate, the relationships of sites of all types to nearby man-made or landscape features should be described and/or mapped as aids to subsequent relocation.

In addition to the general information referred to in the previous paragraph, quantitative data on the composition of artifact assemblages are also required (see Appendix IV for further discussion and lists of suitable data categories). The recording of small sites (20 artifacts or less) in terms of these categories must be total. Large sites (21 or more artifacts) may be totally or partially recorded at the discretion of the field archeologist. Partial recording may take any one of several forms, the choice between which will again be at the discretion of the field archeologist and will normally depend on practical limitations of time and manpower. All well defined tool or ornament types, such as projectile points and other time markers, should be described and sketched and/or photographed wherever encountered. For other classes of artifact, the only feasible procedure at very large sites may be some sort of informal spot checking with estimates based on sample counts in selected areas. If comparatively small sites are involved, a systematic random or stratified sampling strategy may be adopted, this course always being the preferred option whenever practical constraints allow. It is essential that, however estimates of artifact assemblage composition are made, the procedures employed be explicitly described on the site form and that the positions of sampled areas be indicated on attached sketch maps.

4. Survey Reports

A final report on the results of the survey (see below and Appendix IA for format and specific instructions) shall be submitted to the BLM District Office within 30 days of the completion of field work. In the case of lengthy reports involving large project areas, or more than one season of field work, a suitable extension of the deadline can be negotiated with the District. Deadlines, whether 30 day or extended, must be taken seriously and a determined effort made to meet them.

All reports must be submitted in three copies, each legibly reproduced and, if lengthy, suitably bound. Maps should be bound in with the text whenever possible. If sites were found, all three copies of the CR report must include a full set of completed site inventory forms. One of the three copies will be retained by the District; the other two will be sent to the State Office which, after review, will forward one copy to the Nevada State Museum via the SHPO.

If courtesy copies are sent to the Nevada State Museum, SHPO or any other individual or organization before BLM District and State Office review (or before completion of any required corrections), the following statement must appear in typed capitals on the title page: "Note: this report has not been reviewed by the Bureau of Land Management and may be superseded by an amended version." All three copies of the report should be accompanied by 1:250,000 scale maps showing the project area location and 7.5' or 15' USGS maps (or an appropriate substitute if suitable USGS maps do not exist) on which the project area, area surveyed, boundaries between federal and non-federal lands, areas of major vegetational zone changes, and site locations are as accurately plotted as the scale allows. In preparing these maps, attention should be paid to the following points.

1. Use clean copies only as maps marked up as a result of previous use are often confusing and difficult to read.

2. Xerox copies should be of good quality and easy to read.

3. Project areas, archeological sites, etc., should be clearly labeled and, if necessary to make them stand out on photocopies, should be inked in with drawing or felt pens.

4. Township/Range/Section numbers should be clearly marked. If they are faint or illegible on the Xeroxes, they should be inked in; if they are missing on the reproduced portion of the map, they should be added.

Maps may never be substituted for a full legal description, as one of their functions is to act as a check on the accuracy of the latter. For small project areas, such as drill pad locations and the beginning and ends of seismic lines, the 1/4 1/4 1/4 level is desirable when accurately determinable. There is one exception to this requirement, namely cases where large numbers of very small project areas are scattered over a large tract (township or groups of townships) of cadastrally unsurveyed ground. In these circumstances, the BLM District has the option of requiring that only the numbers of such projects per cadastral unit (township or township/section as appropriate) be specified in the legal description. For example, the legal description for numerous soil pits scattered over several cadastrally unsurveyed townships might read as follows: T. 5 N., R. 60 E.: 10 pits; T. 6. N., R. 61 E.: 40 pits or T. 5 N., R. 60 E., Section 4: 5 pits; Section 5: 2 pits, etc. Non-BLM archeologists should note that abbreviated legal descriptions of this type are acceptable only with the prior approval of the BLM District Office.

After completing the field work, on that work-day or (if after close-of-business) on the one following, the field archeologist shall contact the BLM District or Area Office and orally report results. If cultural resources are found for which avoidance or mitigation measures are recommended, he must also submit a short written report to the District or Area Office immediately upon leaving the field, containing the following:

1. Location (full legal description and maps) of project area.

2. Nature of impacts, when work causing them is expected to start and the estimated completion date.

3. Location (legals and maps) and summary descriptions of archeological sites.

4. Recommendations for avoiding or minimizing impacts to Cultural Resources.

For many projects, timely information on most of these points is essential if the adequacy of recommendations is to be reviewed by the District before work on the project actually starts and if effective attempts are to be made to monitor operator compliance. If work on the project starts before cultural resource field operations have ceased, the field archeologist must immediately so inform the District or Area Office.

See Appendix III for a more detailed discussion of avoidance/ mitigation procedures for seismic lines.

III. Large Projects

A "large project" is defined, in this context, as one requiring an Environmental Impact Statement" (EIS) or other pre-commitment study in which alternative sitings are proposed and evaluated in terms of their differential effects on the human and non-human environment. The principal tools for the evaluation of effects on cultural resources in these studies are the "Existing Data Review" and the "Class II Inventory". The following briefly summarizes Nevada BLM standards for the compilation of Existing Data Reviews and for the design and implementation of Class II surveys.

1. Existing Data Review

The Existing Data Review shall take the form of a narrative describing the human history of the project area and its immediate environs using all relevant sources—written, oral and archeological—including any available BLM regional overview data. All previously recorded sites must be identified and listed. Particular attention shall be paid to sites on, nominated to, or eligible for, the National Register of Historic Places, and the data relating to them presented in tabular form as follows:

Site No.
Legal Description
Ownership
Site Type/Function
Cultural Affiliation/Historical Theme(s)
Date of Site
Formal Recognition
Site Significance/Evaluative Criteria

2. Class II Inventory

The objective of the Class II inventory is to provide systematic field sample data supplementing those of the Existing Data Review. For most projects, minimal acceptable coverage is 10%. Overall design and specific field procedures, however, will vary according to the adequacy of existing information and the size and nature of the project.

1. Linear projects. These include such facilities as roads and pipe and transmission lines. The routes are seldom flagged in advance of survey and locations are often not precisely identifiable on the ground. Professional judgment is therefore required in the siting of sample units which, whenever possible, will be legally definable. These units will have minimum dimensions of 1/8th mile by 1/2 mile spacing will be one sample unit per 5 mile stretch of line or road (10%). The maximum transect interval within each unit will be 30 m. Alternative strategies, acceptable to the BLM and SHPO, may be permissible in some circumstances.

2. Non-linear projects. Small project areas (plant sites, etc., occupying less than 640 acres) will be sampled at the 25% level. Sample units will be minimally of 40 acre size and, whenever possible, will be legally definable. The maximum transect interval will be 30 m as for most linear projects. Sample unit size and survey intensity for very large project areas (e.g., oil, gas and geothermal study tracts) will depend on known site densities and shall be determined following consultation between the field archeologist, SHPO and BLM.

IV. Antiquities Permits

As indicated, all persons in charge of archeological fieldwork on BLM lands in the State are required to hold a valid Department of Interior Antiquities Permit for Nevada (see Appendix II for the requirements for granting of a Permit).

Non-compliance by the Antiquities Permit holder with the standards set forth in these Guidelines is grounds for revocation or non-renewal of the Permit. The following is a partial list of instances of non-compliance which can lead to this action.

1. Substandard field work as evidenced by failure to record sites which should have been observed had required procedures been followed.

2. Failure to meet report submission deadlines.

3. Failure to correct and return substandard work within the time-frame stipulated by the BLM Area, District or State Office.

4. Use of unauthorized personnel as field supervisors.

V. BLM Review & Administrative Procedures

1. Review & Minor Corrections

It is the responsibility of the District or Area Office to ensure that the guidelines are complied with by contract archeologists and other contributing organizations. Final reports should be carefully reviewed at the District or Area Office and, if they fail to comply with the guidelines, or have other deficiencies, should be returned to the source for correction. Unsatisfactory work should never be forwarded to the State Office until every effort has been made at the District level to have its deficiences remedied. If necessary, the District should remind non-BLM archeologists that failure to make timely corrections to sub-standard work is grounds for revocation of their Antiquities Permits as is failure to meet submission deadlines.

Minor corrections, expansions or clarifications added to reports during State or District review should be legibly written (in ink, not pencil) and should be initialed and dated by whoever makes them. Marginalia of the (?) or (!) variety are unhelpful and should be avoided unless backed up by formal correction or clarification.

To facilitate curation procedures, the bags containing collected artifacts should be labeled with the CR report number, an indication of the contents, the collector's name, the date of collection, and the NSM number (if known) as well as the BLM site number.

2. Addenda

Addenda, particularly multiple addenda to the same report, cause confusion, and their use should be restricted to corrections of existing reports and to follow-up work (but only if occurring reasonably soon after the completion of the original report) within the same project area. Since the "existing data review" provides adequate cross-referencing, addenda should never be used as a means of grouping together separate projects from the same general area.

3. CRES RATINGS

All sites for which adequate site forms exist should be assigned an S (significance) rating in accordance with the following criteria. Note that any properly filled out Nevada BLM or Nevada BLM approved site form is by definition "adequate" for CRES rating purposes; inadequately filled-out forms from contract archeologists or other contributing agencies should be returned to source for correction/amplification so that the appropriate S ratings can be assigned by the District or Area.

S1. S1 sites have clear potential for public instruction or for yielding scientific information of importance on the national, State or local level; have important connections with major historical events or personages; and/or possess cultural value for segments of the modern population. Most aboriginal sites falling into this category will be in relatively good condition and will either be rare or unique (e.g., Early Man) or will be large and particularly well-representative of their types.

S2. This rating applies if the criteria for S1 rating are only minimally met. The site is generally in good condition and further evaluation could lead to reassessment. S2 sites are usually not unique or very rare, lack important historical associations and are not particularly well-representative of their types. Aboriginal camps or villages which are large but do not have great antiquity and have only limited depth potential are suitable for this rating. Typical S2 historic sites include recently abandoned ranches, small mining camps, cemeteries, railbeds, roads and trails.

S3. Typically, S3 sites show little depth, no or very few features and, if old, are small, or if large, are comparatively recent and diffuse. The site may have been damaged by recent activities, but some scientific or educational value remains. In general, a site not rated S1 or S2 but still partly or wholly extant, will be S3 rated. Common aboriginal S3 sites include seasonal camps, hunting and gathering activity areas, isolated lithic artifacts or potsherds, chipping stations, and lithic workshops and quarries; common historic period S3 sites include dumps, isolated buildings and other structures and small mining operations.

S4. S4 sites no longer exist, because of vandalism, illicit collection or commercial destruction or because of archeological collection or excavation.

Significance ratings for sites for which adequate site forms do not exist are given below. These ratings should only be used when information about the current status of sites is insufficiently detailed and/or when there are definite and substantial grounds for doubting its reliability. They should not be used to indicate uncertainty about the correct rating of adequately recorded sites.

S01. Probably S1 but not adequately recorded
S02. Probably S2 but not adequately recorded
S03. Probably S3 but not adequately recorded
S04. Locus of destroyed/collected site, the exact position of which is unknown.

4. Seismic Lines

See Appendix III for a statement of BLM policy on CR clearance of seismic lines. Appendix III also summarizes parts of the general guidelines and is suitable for use as a flyer informing seismic companies of their responsibilities.

5. Compliance

The District or Area Office, as appropriate, is responsible for monitoring operator compliance with the protection requirements approved by the District Manager. To ensure that compliance is adequate, spot checks should be instituted and, if instances of non-compliance are identified, operators reminded of possible penalties (termination of project or withholding of bond).

APPENDICES (attached)

IA. CR Inventory Form/Specific Instructions

IB. Examples

II. Antiquities Permit Requirements

III. Seismic Line Flyer.

IV. Data Categories

APPENDIX IA: CR REPORT FORMAT/FIELD WORKSHEET

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

CULTURAL RESOURCES REPORT FORMAT/FIELD WORKSHEET

1. CR Report No.

2. Date(2) of Field Ops

3. Archeologist or DAT

4. Project Name & Description/Description of Potential Impacts

5. District Office

6. County and State

7. Planning Unit/Resource Area

8. Land Status

9. Legal Description

10. Relationship to Cadastral Markers

11. Relationship to Other Permanent Features

12. Map Reference

13. Purpose of Survey

14. Consultations/Existing Data Review

15. Vegetation Zones

16. Soils, Topography

17. Nearest Water

18. Field Techniques

19 Findings

20. National Register Recommendations

21. Summary and Avoidance/Mitigation Recommendations

Note: "The techniques used in this survey were such that most cultural resources existing in the project area visible to surface examination should have been found. If, however, cultural resources are subsequently discovered that could be adversely affected by project-related activities, the latter should immediately cease and the ______________ District Manager should be immediately informed."

22. Project Area/Length of Line ______
Area Surveyed:_____ acres
Transect Interval/No./Type

23. Time Expenditure

Field (including travel):________hrs.
Office:______hrs.
Total:_____hrs.

24. Submitted by:________________________________. Date:________
Title:________________________________.
Reviewed by:________________________________. Date:________
(District or Area Archeologist)

25. Approved by:________________________________. Date:________
(D.M. or A.M.)

CULTURAL RESOURCES FIELD WORKSHEET: SPECIFIC INSTRUCTIONS

Use: Form NSO 8100-3 has been designed as a field worksheet, but in some cases (very small projects, some negative reports) it may be typed and submitted as a final CR Report together with necessary attachments (maps, photos, site inventory forms, etc.).

Specifics: The following numbered paragraphs correspond to the numbered entries on the worksheet. Entries not listed are self-explanatory.

1. The CR Report number is taken from the District ledger and will be entered by the District Archeologist upon completion of the report. The number of negative reports should be followed by a capital N in parentheses (N), positive by a capital P (P).

3. Name of person(s) who actually carried out and/or supervised the investigation.

4. Brief description of project (include BLM file or job number if available). The nature of the proposed project impacts should be described in order to give the reader some idea of the kinds and extent of disturbance envisaged. Information on this point is essential where archeological remains are present and a recommendation has to be made (and subsequently reviewed by the SHPO) to protect them. It is also desirable—as a matter of record—for project areas where the results of survey are negative and should be included in every report.

8. If under Federal management, specify agency (BLM, Forest Service, BIA, etc.); if non-Federal, specify ownership (private, state or local government, etc.). If land status mixed, distinguish between BLM and non-BLM lands in legal description and mark boundaries on project map.

9. With the exceptions given in the general guidelines, a full legal description must always be provided for each area surveyed ("see map" is unacceptable). Whenever possible, legal descriptions of small project areas (including ends of seismic lines, etc.) should be at the 1/4 1/4 1/4 section level. If desired, UTM coordinates can also be given but never as an alternative to a full description in terms of township/section system. Legal descriptions for unsurveyed ground should be based on the protraction diagrams available from the Cadastral Survey (estimation from the nearest SE corner can lead to serious errors as the Cadastral Survey may section unsurveyed ground from some other corner). If protraction diagrams are unavailable, the method used to interpolate section boundaries must be specified and the word "unsurveyed" added to the legal description.

10. If the positions of cadastral (section, quarter section) markers are known, specify the relationship of the project area to them in feet or meters (e.g., SW corner of project area/SW end of line 737 ft. from quarter corner along given compass bearing). If they are unknown, so state.

11. As an aid to reidentification on the ground, state the relationship of the project area to permanent man-made (roads, buildings, etc.) or natural (hills, water courses, ridges, etc.) features.

12. Reference should always be to best USGS Quad or AMS topographical sheets available. If the best topographical is a 1:250,000 quad, give additional reference to BLM planning unit map. Relevant portions of all referenced maps should be attached to the report. Mapped features should include: project area, area(s) surveyed (if different from preceding and when appropriate), vegetation zones (see Entry 15), land status, areas of different survey intensity, and archeological sites.

13. For most Class III surveys: "clearance" or "clearance and inventory" as appropriate.

14. Background sketch of length commensurate with scope of project, or of importance of findings, of prehistoric and historic archeology of area. Reference should always be made both to the National Register (most recent monthly supplement including eligibility list, giving volume and number), and to the BLM District Office files. If there is no record of previous work in or near the project area, that fact should be explicitly stated. In the case of many smaller surveys—particularly those producing negative results—reference to National Register/BLM office files will be sufficient in itself to meet the requirements of this entry.

15. The nature of the vegetation cover of the project area should be specified using the classification given below (latter largely based on Young, Evans & Tueller, "Great Basin Plant Communities—Pristine & Grazed", NAS Research Paper, No. 6 (1976), pp. 186-216, Table I). In cases where two or more vegetation types occur in a project area, their boundaries should be plotted on maps of suitable scale (the boundaries of the project area, of course, should also be plotted on these maps).

1. Rabbitbrush/greasewood/grass (saline bottomlands)
2. Greasewood/saltgrass (wet saline bottomlands)
3. Greasewood (semi-playa)
4. Greasewood (alkali flats)
5. Grass/forbs/sedges (semi-wet meadow)
6. Big Sagebrush
7. Low Sagebrush
8. Whitesage/budsage/grass (silty desert flats)
9. Shadscale/grass
10. Pinyon/juniper/grass
11. Mountain Brush (intermediate mountain slopes)
12. Conifer/aspen (high mountain slopes)
13. Creosote
14. Barren playa
15. Irrigated cropland
16. Other (specify)

All identified plant species should be listed and ranked according to abundance. In zones characterized by a clumped distribution of vegetation, density should be specified in terms of the average distance between clumps.

16. Identify major landforms (specifying slope variation) and briefly describe soils.

17. The general availability of perennial surface water in or near the project area should be specified. Reference should also be made to seasonal and/or extinct surface waters.

18. Briefly describe survey techniques. Provide data on crew size and spacing, type of transects, starting points, and directions of sweeps. Note any factors affecting reliability of results (e.g., dense vegetable cover, adverse weather, etc.).

19. List all cultural resources found (by site number) with information on location and vulnerability to project-related impacts (additional information will be included on the attached inventory form for each site). If no finds are made, state "none".

20. See 36 CFR Part 1202.6 criteria for evaluating properties that may be eligible for the National Register. For all properties believed eligible cite qualifying criterion/criteria under 36 CFR Part 60.6 or, if there is some question, note the need for further assessment to determine NR eligibility. If no sites are considered eligible for NR listing under 36 CFR Part 60.6 criteria, so state.

21. Preface avoidance/mitigation recommendations with a summary of any finds made and a brief discussion of their general significance in terms of the existing data base and relevant research questions. Length should be commensurate with the importance of the findings. When convenient, some or all of the summary/discussion may be placed elsewhere (e.g., in Entry 19 or 20). Avoidance recommendations must be clear and definite and must never be worded in such a way as to imply that compliance is optional ("if possible") or unimportant. The disposition of collected material must be specified. If no avoidance/mitigation recommendations are necessary, so state.

22. The results of survey will be presented as per the format given on the work sheet (see Appendix IB for concrete examples of how the format is used in specific circumstances).

Note that area measurements may be given in acres only or in acres and hectares but not in hectares only; but that linear measurements may be given in either meters/kilometers or feet/miles.

Non-Linear Projects

"Project Area" equals area (acreage) within which the proposed action will take place.

"Area Surveyed" equals acreage actually walked over at the transect interval specified in the following entry. In many cases, the "area surveyed" will be coterminous with the "project area".

"Transect Interval/No./Type". For "type" put "linear" (= straight line) or "zigzag" as appropriate; other terms self explanatory.

Linear Projects

"Length of Line" equals length of project (fence, seismic, pipe, etc., line).

"Area Surveyed" for narrow project areas (official corridor widths c. 30 m or less) equals length of line actually walked over x 30 meters (nominal corridor width as defined in the General Guidelines), converted to feet (98.5) and divided by 43,560 (square footage of acre). Wide linear projects (corridor width substantially greater than 30 m) will normally be surveyed by means of 2 or more transects. Acreages for such projects should be calculated on the basis of the official corridor width.

"Transect Interval/No./Type". Same as Class III, non-linear.

Project areas and areas surveyed should be clearly marked on a large scale map accompanying the CR report. If, as a result of survey, it is recommended that projects be partly or wholly resited, the new sitings should be fully described and mapped.

24 & 25. All copies of all CR reports—including those by contract archeologists and other non-BLM personnel—must be signed by the District or Area Archeologist and (if appropriate) by the District or Area Manager after review.

APPENDIX IB: EXAMPLES

Example 1. Class III (non-linear). Land transfer (quarter section). Surveyed by linear transects, 30 m apart.

Presentation of Results

Project Area: 160 acres
Area Surveyed: 160 acres
Transect Interval/No.Type: 30 m/26/linear

Example 2. Class III (linear). Seismic line, 8 kms long, marked by flagged corridor, 50' wide. Surveyed by 2 linear transects, 10 m apart.

Presentation of Results

Length of Line: 8 km
Area Surveyed: 59.4 acres
Transect Interval/No./Type: 10 -/2/linear

Note that width of flagged corridor is irrelevant, acreage being calculated on basis of 30 m wide nominal corridor (see General Guidelines).

Example 3. Class III (linear). Powerline, 1 mile long with corridor width of 400'. Surveyed by 6 linear transects, 66' apart.

Presentation of Results

Length of Line: 1 mile
Area Surveyed: 48.5 acres
Transect Interval/No./Type: 66 ft/6/linear

Example 4. Class III (linear). Fenced enclosure, 40 m by 40 m. Surveyed by single zigzag transect around perimeter.

Presentation of Results

Length of Line: 160 m
Area Surveyed: 1.19 acres
Transect Interval/No./Type: NA/1/zigzag

Example 5. Class III (linear & non-linear). Drill site, 100' by 100', plus access road, 1 km long. Drill site surveyed by linear transects, 5 m apart; access road surveyed by 2 zigzag transects, 6 m apart.

Presentation of Results

Project Area/Length of Line: 0.23 acres/1 km
Area Surveyed: 0.23 acres (drill site) + 7.4 acres (road)
Transect Interval/No./Type: Drill Site: 5 m/5/linear; Access Road: 6m/2/zigzag.

Example 6. Partly Class III and partly reconnaissance. Land transfer (whole section). NW corner (c.190 acres) mountainous and heavily vegetated: surveyed by single meandering transect (see map). Remainder of area surveyed by linear transects 30 m apart.

Class III

Project Area: 640 acres
Area Surveyed: 450 acres
Transect Interval/No./Type: 30 m/54/linear

Reconnaissance

Project Area: 640 acres
Area Surveyed: 190 acres
Length of Route Walked: c.2 1/2 km

APPENDIX II: FEDERAL ANTIQUITIES PERMIT REQUIREMENTS FOR THE STATE OF NEVADA

A Federal Antiquities Permit is required for all cultural resource survey work on Bureau of Land Management lands in Nevada whether or not such work involves excavation or collection of artifacts. The minimum requirements for the granting of an Antiquities Permit are given below for the two key categories of personnel.

1. Principal Investigator (= the person in general charge specifically to be designated as such on the Antiquities Permit). M.A. or M.S. degree in a relevant discipline (normally history, architectural history or anthropology) from an institution of recognized academic standing. In addition to meeting the minimum academic requirements, the Principal Investigator must also possess substantial experience on relevant cultural resource projects in Nevada or elsewhere in the Great Basin. In some cases, Great Basin experience may be waived if the applicant can demonstrate competence in cultural resource work of a generally similar character in some other region of western United States. The Principal Investigator is required to be directly-involved in all major surveys (those over 300 acres in size), all test excavations and all collections/field evaluations of sites comprising 20 or more artifacts. By "directly-involved" is meant physical presence at the site of work for a period not less than 10% of the total duration of the field work. The Principal Investigator, as the actual Permit holder, must review and sign all cultural resource documents done under the authority of his Permit, and is fully and solely responsible for the adequacy of such documents.

2. Field Supervisor (= the person in direct charge of field work specifically to be designated as such on the Antiquities Permit). One year of relevant graduate work and/or present enrollment in a relevant higher degree (M.A. or M.S.) program. In addition to the academic requirements specified above, the field supervisor must have had substantial field experience (100 days minimum) in Great Basin archeology.

There are two partial exceptions to the above requirements.

1. The Field Supervisor and the Principal Investigator are the same person. In this case, the applicant must meet both sets of criteria, i.e., must possess both substantial field experience in relevant Great Basin Cultural Resoruce projects and an M.A. or M.S. degree.

2. The Principal Investigaor is such in name only (e.g., Dean or President of a university). In this case, the roles of Principal Investigator and Field Supervisor are effectively combined and the requirements for the Field Investigator are the same as in the previosu case (MA. or M.S. degree and substantial Great Basin experience).

Once the permit has been issued, any changes in field supervisory personnel must be formally approved by the BLM in advance of field work.

As already stated, the Principal Investigator--as the actual holder of the Permit—has full responsibility for the adequacy of the final report and is expected to take his review duties seriously, ensuring that BLM cultural resource guidelines are complied with in all particulars and causing errors to be corrected and obscure writing clarified. Unprofessional presentation of results (e.g., poor organization, frequent misspellings and bad English) will be taken as evidence of inadequate review by the Principal Investigator.

The BLM reserves the right to refuse to grant Antiquities Permits to otherwise qualified applicants whose previous work on Federal or non-Federal cultural resource projects is deemed unsatisfactory by Nevada District or State Office archeological staff. "Unsatisfactory", in this context, refers not only to inadequacy of the final product but also to failure to meet submission deadlines.

APPENDIX III: PROTECTION OF CULTURAL RESOURCES AND GEOPHYSICAL TESTING

The increased occurrence of geophysical projects in Nevada and the national goal of expediting energy exploration require that a clarification of certain BLM responsibilities for protecting cultural resources be provided.

Archeological clearance of seismic lines is addressed below to acquaint land users and contract archeologists with their respective responsibilities. It is hoped that this information shall decrease any confusion that presently exists and thus lead to a more efficient implementation of required procedures. In the following discussion, the term "seismic line" should be understood to include not only the line itself, but also any proposed access routes.

When bladework or other terrain-disturbing methods are employed, the impacts on cultural resources, if present, are obvious. Artifacts are broken or damaged, archeological features destroyed and the associations between artifacts and archeological features disrupted. However, some commonly employed seismic techniques used today do not cause the degree of damage described above. In fact, the potential impact of these techniques could be considered sufficiently minimal to obviate the need to perform clearance surveys. This, however, is not a tenable attitude as potentially significant impacts still occur due to the vehicular use of the line by the field crews. Such use often leads to the creation of a worn, highly visible path providing a potential access route for later land users. The resulting cross-country traffic subsequently occurring on many of these routes often causes severe impacts on cultural resources.

Cultural resource clearances of seismic lines are therefore required, both for those involving bladework or other terrain disturbing techniques and for those involving cross-country vehicle use only. There are the following exceptions (seismic lines not requiring cultural clearance):

1. Seismic lines on existing roads or their shoulders (seismic lines within the undisturbed parts of existing road rights-of-way do require cultural clearance). good

2. Seismic lines in active washes.

3. Seismic lines retracing a route previously determined to be devoid of cultural resources (if cultural resource sites were identified during the previous survey, and were not collected, their positions must be reidentified and appropriate protective measures taken, before the new seismic work can begin). — This would see to me to be a remote instance -

Results of Class II regional sampling surveys in support of the energy program may allow additional exceptions due to physically definable areas of low cultural resource density or to the identification of soil types comparatively immune to vehicular impacts.

In conducting seismic line clearances, certain procedures must be followed:

(1) The proposed line must be flagged by the geophysical company prior to archeological inspection. In flagging the line, vehicle use should be kept to the minimum consistent with getting the job done. The maximum interval allowable between flag stations depends on the nature of the terrain. On flat ground with unimpeded visibility between points, flag stations may be up to 1/2 mile apart; in hilly or broken terrain, where adjacent flag stations are not invervisible, the maximum allowable spacing is 1/8th mile.

(2) As specified in Antiquities Permit stipulations and BLM guidelines, contract archeologists must contact the BLM District before starting field work in order to confirm the need for a survey, to acquire knowledge of any previous surveys in the immediate area, and to discuss timetables and procedures.

(3) The geophysical company must provide adequate advance notice of the need for clearance work to be performed. It is both unprofessional and unacceptable for notice to be provided only hours prior to departure of seismic crews to the field.

(4) Upon completing the survey, the contract archeologist must phone or visit the BLM District or Area Archeologist to inform him of results and to devise appropriate avoidance/mitigation recommendations for any cultural resources which may have been found. If the survey results were negative, the DA or AA will give oral authority for the project to proceed at this point. If satisfactory recommendations cannot be devised, the project cannot proceed until they can be.

(5) Once avoidance/mitigation recommendations are agreed upon by the BLM District/Area Archeologist and the contract archeologist, the latter will communicate them to the responsible Geophysical Company, surveyor or crew chief in the form of written instructions (a brief handwritten note will often do). A copy of these instructions must be submitted to the BLM District/Area Office as an attachemnt to the report required by the next entry.

(6) If cultural resources are found for which avoidance or mitigation measures are recommended, the contract archeologist must submit a short report to the District when leaving the field containing the following:

- (a) Location (full legal description and maps) of project area.
- (b) Nature of impacts, when work causing them is expected to start (or has started) and the estimated completion date.
- (c) Recommendations for avoiding or minimizing impacts to Cultural Resources.
- (d) Locations (full legals and maps) and summary descriptions of all archeological sites.

(7) Geophysical company traffic must adhere to the archeologically cleared routes. In the past, deviation from these routes, particularly in wet weather, has been frequent and, as a result, impacts on cultural and other resources have been much more extensive than indicated in the initial proposal. In order to avoid this problem, the geophysical company should instruct flagging crews to identify and flag points on the route where deviations can be anticipated to occur, so that potential detours can be archeologically examined as part of the survey of the main route.

(8) Movement of artifacts off the seismic line to another location is not an acceptable form of mitigation, the only permissible protective measures being avoidance or collection (see Nevada BLM guidelines for collection policy). Artifacts and collection loci must be described on site inventory forms and in CR reports. Costs arising from the descriptive analysis and cataloguing of collected finds are to be incurred by the geophysical company, as the agent responsible for the impacts on these public resources.

A large proportion of the District's time will be devoted to monitoring company compliance with avoidance/mitigation stipulations, maintaining records of completed clearance work, and providing relevant and up-to-date information to contract archeologists. The District can, however, supply personnel for performing clearance work for small projects as time allows.

The possibility exists that, in the future, the demand for BLM or contract archeologists' time may exceed the supply. If this situation should arise, then the appropriate course will be the adoption of a sampling (Class II) strategy rather than the total abandonment of seismic line surveys.

If any further information is required about the archeological clearance of seismic lines, contact the appropriate BLM District Archeologist or Richard Hanes (Telephone Number 784-5748) at the State Office.

APPENDIX IV: DATA CATEGORIES

Aboriginal Sites. Field recording of aboriginal lithic and/or ceramic scatters should identify and describe (size, shape, material type) all cultural diagnostics or other highly modified or unusual artifacts such as core choppers, manos, metates, worked bone objects, scrapers, projectile points, etc. Normally, all such artifacts (or representative samples, if numerous), whether collected or not, should be drawn to scale on the site form or on an attachment to it (use common sense in deciding what to draw: projectile points will always be worth the effort but some manos or metates may not be).

The characteristics of artifacts not definable in terms of these criteria, however, also require detailed recording, particularly since, in accordance with current policy (pp. 5-6 of General Guidelines), many such artifacts are excluded from discretionary collection by field archeologists. In Nevada, artifacts of this kind perhaps constitute a higher proportion of observed cultural resources than in any other region of Western North America; and accurate and detailed field recording is a necessity if reliable information on the commonest and most characteristic expression of the past human occupation of the State is to play its proper part in the development of regional plans. Appropriate data categories for the field recording of "undiagnostic" lithic and ceramic artifacts are set out below.

1. Lithics. Always specify material types.

I. Bifaces (Production Sequence)*

Type A. Primary goal: cortex removal, establishment of striking platforms for removal of primary thinning flakes. Initial shaping of an irregular or nodular piece into one with a definite continuous edge. Irregular edges and outline; thick in relation to length and width; a few flake scars may extend across most of face; prominent surface irregularities; high proportion of hinge fracture flake terminations; angular in cross-section with a sinuous midline ridge.

Type B. Primary goal: rough thinning and regularization of edges by means of percussion flaking. Edge platforms maintained through strengthening and repositioning; faces smoothed by removal of major surface irregularities. Object piece still thick but with cross-section less angular and more rounded than before; midline ridge is prominent, moderately regular and well-centered though sinuous; tip and base are distinguishable.

Type C. Primary goals are further thinning of cross-section (to approximate final thickness) and further regularization of edges by means of soft billet (flake scars typically broad and expanding). Pressure edge retouch may be located irregularly along edges in preparation for additional flake removals; edge nearly straight edge-on and often centered. Fairly symmetrical in plan; tip and base well-defined. Flakes often removed in series extending across midline; lanceolate forms may exhibit parallel oblique flaking at this stage.

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*Adapted from "An Analysis of Prehistoric Artifacts from Lassen Naitonal Forest, California", L. C. Pippin and E. M. Hattori, Desert Research Institute, University of Nevada, Social Sciences Technical Report Series No. 15, pp. 19-30 (1980).

Type D. Primary goal is the production of regular edges which are straight when viewed edge-on. Thick arris remnants along edge are removed by pressure flaking. Highly symmetrical in plan and regular in cross-section. Faces often completely covered by long, narrow pressure flake scars which extend beyond the midline of smaller items. Hafting/shoulder elements normally absent or unfinished. Often constitutes a "preform" stage.

Type E. Finished artifact (if named stylistic or functional type, so refer to).

II. Flake categories

A. Shatter (miscellaneous manufacturing by-products)—featureless chips, angular splinters, amorphous chunks.

B. Broken flakes—pieces on which the bulb of force and striking platform are missing.

C. Decortification flakes—dorsal surface entirely or partly covered by cortex.

D. Interior percussion flakes—struck from core interior or bifacial blank, often with prominent bulbs of force and frequently with plain simple platform surfaces.

E. Biface thinning flakes—commonly exhibit multifaceted striking platform edge; thin in cross-section and broad in outline.

F. Pressure flakes—relatively small with minute acuminate bulbs of force, thin cross-sections, and symmetrical outlines.

Presence or absence of use marks visible to naked eye and, if further reduction has occurred, whether it is unifacial or bifacial, should always be specified.

III. Cores. Primary goal is flake production. Size, shape, flake scar orientation(s) variable. Any piece from which flakes have been detached and which is not readily identifiable as a stage in biface manufacture should be classified under present heading.

2. Ceramics

Cultural Affiliation

Shoshonean
Paiute
Pueblo
Lower Colorado
Fremont
Historic
Other:__________

Physical Characteristics

Decorated (specify design element and color)
Corrugated (specify color)
Plain ware (specify color)
Rim Sherd
Body sherd

Historic Sites. All technologically relevant attributes should be described. For bottles or bottle fragments, important attributes include lip and collar forms, base marks and form, seams, embossing, closure types and glass type and color. All letters, numbers and symbols should be described. For tin cans, note should be taken of seams, material type, embossing, and method of closure. Whenever appropriate, verbal descriptions should be supplemented by scale drawings.

Types of analyses that are not required in the standard cultural resource report include lithic use-wear analysis, lithic technological reconstructions, trace element analysis, obsidian hydration studies and microscopic temper studies.